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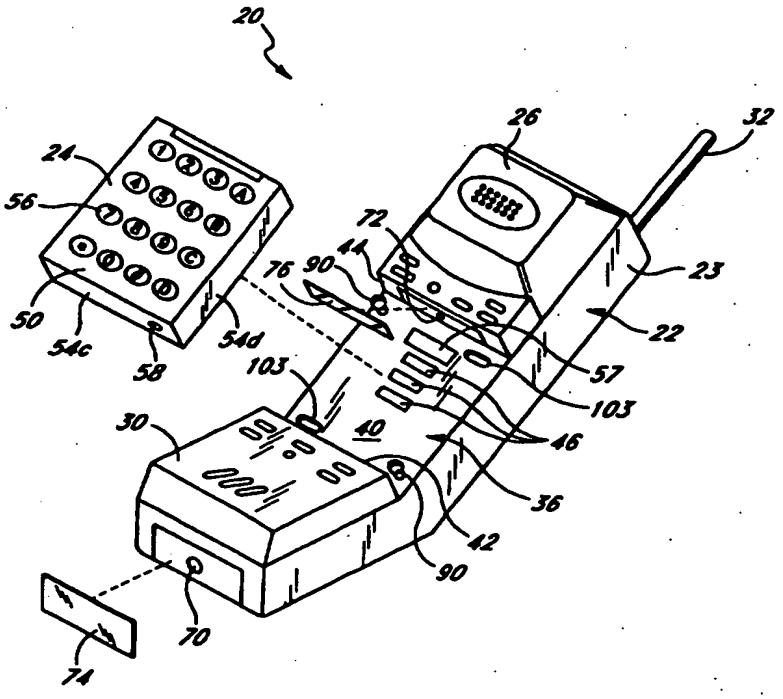
(54) Title: TELEPHONE WITH DETACHABLE REMOTE KEYPAD

(57) Abstract

Disclosed is a telephone (20) having a detachably mounted remote keypad (24). The telephone (20) is of the type having an integrated handset (22) including an earpiece (26), a mouthpiece (30), and a keypad (24) for dialing. The keypad (24) may be detached from the handset (22) so that a user may depress keys on the keypad (24) without having to remove the handset from his ear. When detached from the handset, the keypad (24) preferably communicates with the handset through a wireless connection, such as through an infrared signal. The preferred embodiment of the keypad includes an infrared transmitter for transmitting a unique serial bit code signal in response to a user depressing keys. The handset (22) includes an infrared receiver and telephone chip for receiving and decoding the signal transmitted by the keypad (24).



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TELEPHONE WITH DETACHABLE REMOTE KEYPAD

Background of the Invention

Field of the Invention

The present invention relates to an improved telephone. More particularly, the present invention relates to a telephone having a detachably mounted remote keypad that enables a user to enter information through the keypad without having to remove the telephone handset from his or her ear.

Description of the Related Art

Many current telephones are designed with the telephone handset and dialing mechanism, such as a keypad, combined into a single unit. Such telephones consist of an integrated handset having a mouthpiece for receiving sound information from a user and a speaker for conveying sound information to the user. A keypad is located on the handset and is usually interposed between the mouthpiece and the speaker. When not being used, the handset is configured to be cradled on a base unit that is attached to a phone line. Typically, the handset communicates with the base unit through an electrical connection, such as a phone cord, or through a wireless connection, such as through an RF transmitter and receiver.

Such integrated handsets are convenient in that they are compact and allow a user to access the keypad even when the user is away from the base unit. However, with the increasing use of integrated voice response (IVR) systems, the handsets also present certain drawbacks. Integrated voice response systems are telephone communication systems that require the user to listen for instructions over the telephone that prompt the user to depress keys on the keypad. By depressing the keys on the keypad, the user activates a corresponding action by the IVR system, such as to play a voice mail message or play a new set of instructions. IVR systems are increasingly being used to give and receive instructions or information over a phone-line, such as for on-line banking, voice-mail systems, and automatic receptionists for businesses.

As discussed, IVR systems require a user to listen for instructions and then depress certain keys on the keypad in order to trigger an action. Since the keypad cannot be conveniently accessed while simultaneously holding the handset to the ear, the handset must first be lowered into view to depress the keys. This makes IVR calls extremely difficult, as it often causes confusion when instructional information is missed while the handset is away from the user's ear. Another major drawback of the current telephone handset design is that because the earpiece is away from the user's ear when depressing keys, there is a loss of tone feedback to the ear while the user is depressing the keys. It therefore becomes difficult for the user to determine if a key is fully depressed or if the key is double hit without tone feedback through the earpiece.

Summary of the Invention

There is therefore a need for a telephone having a handset with a keypad that does not require the handset to be removed from the ear in order to depress keys on the keypad. The telephone should also provide a way for callers to interact with integrated voice response systems without the loss of voice information while depressing keys on the keypad, such as by providing tone feedback from the earpiece while simultaneously allowing keys to be

depressed. Such a telephone should desirably provide a level of comfort and functionality not presently available in handheld telephones.

The aforementioned needs are satisfied by the present invention. A detachable keypad described herein advantageously allows a telephone user to retain the handset next to his or her ear while simultaneously depressing keys on the keypad. Because the keypad is detachable, a single handset may be configured to interact with multiple keypads, each having customized functionality. This advantageously allows a single handset to be customized for particular users or functions by simply varying the particular keypad that is attached to the handset.

In one aspect of the invention, there is disclosed telephone handset having a keypad module located between a mouthpiece and a telephone receiver. The keypad module is selectively removable from the handset. There is a communication path between the keypad module and the handset that permits signals to be controlled by the keypad module when the keypad module is separated from the handset.

In another aspect of the invention, there is disclosed a telephone handset comprising a mouthpiece and a receiver and a plurality of keypad modules, each keypad module being selectively attachable to the handset. Advantageously, there is a communication line between the handset and each of the keypad modules. The communication line permits the passage of signals between the keypad modules and the handset when the keypad modules are separated from the handset.

Yet another aspect of the invention relates to a telephone handset comprising a receiver, a mouthpiece, a selectively detachable keypad module located on the handset, and means for transmitting a signal between the keypad module and the handset. In one embodiment, the signal is a dual tone multifrequency signal that is controlled by the keypad module. In yet another embodiment, the means for transmitting a signal between the keypad module and the handset comprises a transmitter on one of the keypad module or the handset, the transmitter configured to transmit a signal, and a signal receiver on the other of the handset or the keypad module, the receiver configured to receive the signal.

There is also disclosed a method of operating a telephone. The method comprises the steps of providing a telephone of the type having a handset having a selectively detachable keypad module and a communication path between the handset and the keypad module, detaching the keypad module from the handset, and depressing keys on the keypad module to dial a telephone number.

Brief Description of the Drawings

These and other features of the invention will now be described with reference to the drawings of a preferred embodiment, which are intended to illustrate and not to limit the invention, and in which:

Figure 1 illustrates a front perspective view of a telephone of a preferred embodiment including a handset and a detachable remote keypad in a detached state;

Figure 2 schematically illustrates how a handset may communicate with a variety of detachable keypads;

Figure 3 shows a rear perspective view of the detachable remote keypad shown in Figure 1;

Figure 4 schematically illustrates the interaction between the keypad and an infrared transmitter;

Figure 5 schematically illustrates the telephone handset circuitry;

Figure 6 illustrates a second embodiment of the telephone of the present invention; and

Figure 7 shows a detailed flowchart of operation.

Detailed Description of the Preferred Embodiments

Figure 1 illustrates a telephone 20 configured in accordance with a first embodiment of the present invention. The telephone 20 includes a handset 22 and a remote keypad 24 that is configured to be removably attached to the handset 22, as described in detail below. The handset 22 is a telephone mouthpiece and receiver combined into one unit, for holding in one hand. The handset 22 includes a housing 23 that encloses a set of conventional telephone electrical components (not shown), as will be known to those skilled in the art. The housing 23 is preferably manufactured of a light, rigid material, such as plastic, or any other conventional material that is used to manufacture telephones. The remote keypad 24 may also be manufactured out of the same type of plastic that is currently used for telephones.

In the illustrated embodiment, the handset 22 is a conventionally-shaped handset having an earpiece 26 and a mouthpiece 30. The earpiece 26 and mouthpiece 30 are configured to be positioned adjacent a user's ear and mouth, respectively, when the handset is being used. A conventional speaker (not shown) is located within the handset housing 23 immediately adjacent the earpiece 26 for conveying sound information to the user in a manner well known in the art. A voice or sound receiver (not shown) is positioned within the handset housing 23 immediately adjacent the mouthpiece 30 for receiving sound information, such as from the voice of the user, in a manner known to those skilled in the art.

The handset 22 also includes an antenna 32 that extends outward from the handset casing 23 near the earpiece 26. The antenna 32 enables the handset 22 to communicate with a telephone base unit (not shown) that is connected to a telecommunication line in a well known manner. Although the handset 22 is illustrated as a cordless-type telephone, those skilled in the art will appreciate that the inventive features of the present invention may also be utilized with any of a wide variety of telephone types. For instance, the present invention could be used with a telephone where the handset 22 is connected to a telephone base unit through a telephone cord, or with a cellular telephone.

With reference to Figure 1, the telephone handset 22 is designed with an open space in its midsection, referred to as recess 36. The recess 36 is of a size and proportion to allow the remote keypad 24 to be attached therein, creating the appearance of a standard telephone, as described in detail below. In the illustrated embodiment, the recess 36 is located on the telephone handset 22 between the earpiece 26 and the mouthpiece 30, although the keypad 24 may also be mounted on a wide variety of locations on the handset 22 and remain within the scope of the invention. For instance, the keypad 24 could be mounted on the back of the handset 22.

An abutment surface 40 on the handset housing 23 defines the bottom surface of the recess 36. A first side surface 42 and a second side surface 44 extend outward from the abutment surface 40 to define opposing sides of the recess 36. A set of electrically-conducting metal strips 46 is located on the abutment surface 40 for transferring power or information to the keypad 24 when it is mounted to the handset 22, as described in detail below. Although Figure 1 illustrates three electrically-conducting metal strips 46 on the handset 22, those skilled

in the art will appreciate that any appropriate number of electrical strips 46 may be used. Further, it is contemplated that any commonly available male and female electrical connectors could also be used.

The remote keypad 24 has a shape that conforms to the shape of the recess 36, thereby enabling a user to mount the keypad 24 in the recess 36. Specifically, the keypad 24 preferably has a substantially rectangular shape defined by a keypad surface 50 and an opposed contact surface 52 (Figure 3) which lies adjacent the abutment surface 40 when the keypad 24 is mounted to the handset 22. Opposed sidewalls 54a, 54b, 54c, and 54d connect the keypad surface 50 to the contact surface 52. Those skilled in the art will appreciate that the keypad 24 and recess 36 may take on any wide variety of shapes and remain within the scope of the invention.

In a preferred embodiment, the remote keypad 24 has dimensions such that when the remote keypad 24 is positioned within the recess 36, the keypad surface 50 of the remote keypad 24 lies flush with the surfaces of the earpiece 26 and the mouthpiece 30, thus creating the appearance of a standard telephone handset. Hence, when a user positions the keypad 24 in the recess 36, the handset 22 appears as a single integrated unit with no noticeable inconsistencies between the keypad 24 and the handset 22. The telephone 20 thus retains an aesthetically-pleasing appearance.

A plurality of keys 56 are located on the keypad surface 50. In a preferred embodiment, a low battery indicator light 58 (Figure 1) is positioned on the sidewall 54c of the remote keypad 24. The low battery indicator light 58 illuminates when battery power to the remote keypad 24 is below a predetermined level, as described below. Because it is located on the sidewall 54c, the low battery indicator light 58 is concealed by the side surface 44 when the remote keypad 24 is attached to the handset 22. This advantageously removes the display of the indicator light 58 when the keypad 24 is attached to the handset so as not to confuse the user by displaying unnecessary lights.

As shown in Figure 1, a display 57, such as a liquid crystal display, could also be incorporated onto the handset 22 or the remote keypad 24. In the illustrated embodiment, the display 57 is located on the handset 22 although a display could also be located anywhere on the keypad 24. The display 57 may be used to convey any wide variety of information to the user. For instance, the display 57 could display the number that is being dialed. The display 57 could act as a "caller ID" to display the telephone number that the telephone is receiving. The display 57 could also be located on the remote keypad 24 when the keypad 24 is used as a personal digital assistant, as described below. The display 57 could take any of a wide variety of shapes and sizes.

In the illustrated embodiment, the keypad surface 50 includes sixteen separate keys 56 arranged in an array fashion, specifically including keys designated as "1", "2", "3", "4", "5", "6", "7", "8", "9", "0", "*", "#", "A", "B", "C" and "D". In a preferred embodiment, the keys are configured to be depressed by a user in order to impart dual tone multifrequency (DTMF) signals. However, the keys 56 on the remote keypad 24 are not limited to function only with DTMF signals. The keys 56 can also be used to control other functions, as described below.

Referring to Figure 2, a single handset 22 may be configured to be attached to various keypads 24, each keypad 24 being customized for particular users or functions. Hence, a single telephone 20 may be made more versatile by providing a plurality of keypads 24 which may be carried by individual members of the household. Each

keypad 24 might require a different access code to be entered before the phone would be functional. Each keypad 24 could also be programmed to store different autodial numbers or to dial only a preselected number. Further the keypad configuration, such as the shape of the keys 56 or number of keys 56, might be varied for different key pads 24 in order to make calls simpler for children or for the elderly. For example, the keys 56 might be made larger for the elderly or could take on a representative symbol for children. Alternatively, the keys 56 could be textured or could have braille symbols to assist the blind. It is contemplated that any variety of alpha-numeric or symbolic keys may be located on the keypad 24 and that the keys 56 may be arranged in any wide variety of spatial configurations.

It is contemplated that the keypad 24 could also be used as a personal digital assistant as well as to dial the telephone 20. For instance, as a personal digital assistant, the keypad 24 could be used to store and display a user's schedule or store telephone numbers and addresses. As a personal digital assistant, the keypad 24 could also be used to store and retrieve electronic mail. In this manner, individuals could carry the keypad 24 as a personal digital assistant and connect it to a handset 22 for use with dialing telephone numbers. Furthermore, it is contemplated that the remote keypad 24 could also be fitted with electrical components so that it could be used as a pager or a beeper to remotely send or receive electronic signals over a telecommunication line in a well known manner.

Figure 3 illustrates a rear perspective view of the remote keypad 24, showing the contact surface 52. A plurality of electrically conducting metal strips 60, which are counterpart to the metal strips 46 on the handset 22, are located on the contact surface 52 of the remote keypad 24. The metal strips 60 electrically communicate with the internal power circuitry of the remote keypad 24 in a well known manner.

The electrically conducting metal strips 46 (Figure 1) on the handset 22 are positioned to mate with their counterpart electrically conducting metal strips 60 on the remote keypad 24 when the handset 22 attaches to the keypad 24. Specifically, the metal strips 60 are positioned such that when a user places the keypad 24 within the recess 36 on the handset 22, the metal strips 60 physically contact and align with the metal strips 46. Toward this end, the metal strips 60 are preferably spring loaded to maintain pressured contact with the metal strips 46. The metal strips 60 and 46 act as a power interface for the transfer of electrical power from the handset 22 to the keypad 24 when the keypad 24 is mounted to the handset 22, as described more fully below. Furthermore, the metal strips 60 and 46 could also used to convey information signals between keypad 24 and handset 22 when the pieces are mounted together.

When detached from the handset 22, the keypad 24 is preferably powered by an internal battery (not shown) that is located in a battery compartment (not shown) within the keypad 24. As shown in Figure 3, a battery compartment access plate 62 is located on the keypad contact surface 52. A user may open the access plate 62 to reveal the battery compartment and gain access to the battery. In the illustrated embodiment, the battery compartment access plate 62 is held in place by a holddown screw 63. Any other well known closure devices may be used to secure the battery compartment access plate 62 in place.

In one embodiment of the invention, the keypad 24 mates with the handset 22 through a pin/keyhole configuration. As shown in Figure 1, a pair of flexible plastic coupling pins 90 extend outward from the abutment surface 40 of the handset 22. In the illustrated embodiment, the pins 90 are located at opposite corners of the abutment surface 40. Each coupling pin 90 is designed with a larger diameter head at the top, and a smaller diameter stem at its base. There is an opening down the middle of the head to allow the two halves of the coupling pin to compress together when pressure is applied to each side.

As shown in Figure 3, a pair of corresponding keyholes 64 are located on the contact surface 52 of the keypad 24. In the illustrated embodiment, the keyholes 64 are located on opposite corners of the contact surface 52. The keyholes 64 are positioned such that each pin 90 may be axially aligned with a corresponding keyhole 64 when the keypad 24 is inserted into the recess 36. Toward this end, the coupling keyholes 64 preferably have a large diameter section 65 that is connected to a small diameter section 66 through a channel section 67.

The coupling pins 90 are of a size and position on the handset 22 so as to exactly engage the keyholes 64 on the keypad 24. When keypad 24 is placed into the recess 36 on the handset 22, the coupling pins 90 are accepted into the coupling keyholes 64, thus allowing the contact surface 52 of the keypad 24 to mate flush with the abutment surface 40 of the telephone handset 22. The large diameter sections 65 of coupling keyholes 64 contain a large enough diameter opening to accept the heads of coupling pins 90 when first mated, leaving telephone keypad 24 slightly off-center to the telephone handset 22. Applying side pressure to the handset 22 in one direction while applying opposite direction pressure to the keypad 24 will cause the coupling pins 90 to compress into the narrow channel section 67 in the keyholes 64. As the handset 22 and the keypad 24 slide into alignment with each other, the coupling pins 90 reach the end of the coupling keyholes 64, which increase in size slightly from the channel section 67 to form the small diameter section 66, thereby allowing for a snap-in-place coupling that can be repeated as many times as is desirable. It is contemplated that the method of coupling the handset 22 and keypad 24 described above is only one of many possible ways to allow the handset 22 to be attached and detached to and from the keypad 24. It is understood that any well known releasable detachment mechanisms could be used.

In a preferred embodiment, when the keypad 24 is detached from the handset 22, the keypad 24 communicates with the handset 22 through an infrared interface. Alternatively, the handset 22 and keypad 24 could communicate through an RF interface. It is also contemplated that an electrical wire could also be used to connect the remote keypad 24 to the handset 22.

In the preferred embodiment, a multifunction infrared receiver 68 (not shown) is located within the handset 22 for receiving infrared signals from the keypad 24. Referring to Figure 1, a pair of infrared sensors 70 and 72 are located on the outer surface of the handset casing 23. The first infrared sensor 70 is located on the bottom end of the mouthpiece 30. The second infrared sensor 72 is located on the side surface 44 of the recess 36. Each of the infrared sensors 70 and 72 electrically communicates with the internal infrared receiver 68. In the illustrated embodiment, infrared filters 74, 76 are mounted on the handset 22 directly in front of the infrared sensors 70, 72, respectively. The infrared sensors 70 and 72 may be any type of infrared sensors

known to those skilled in the art, such as infrared phototransistors. Furthermore, any number of infrared sensors may be positioned at various locations on the handset 22.

Referring to Figure 3, the keypad 24 includes a pair of infrared light-emitting diodes (LEDs) 80 and 82 for conveying an infrared signal to the handset 22. The LEDs 80 and 82 are located in a cavity 84 that extends into the sidewall 54a on the keypad 24. In a preferred embodiment, the LED 80 is positioned so that it faces towards the keypad surface 50 of the keypad 24. The LED 82 is positioned so that it faces in a direction that lies at an angle relative to the direction in which the LED 80 faces. The angular relationship between the direction of the LEDs 80 and 82 preferably increases the operating angle of the infrared signal that is transmitted by the LEDs 80 and 82. Those skilled in the art will appreciate that two LEDs are not necessary, but the operating angle and range increases over the use of just one LED. More than two LEDs may also be used.

In the preferred embodiment, an infrared filter 86 is placed over the cavity 84 to protect the LEDs 80, 82, and to filter the light emitted by the LEDs 80, 82 in a manner well known in the art.

The LEDs 80, 82 are driven by a multifunction infrared transmitter 92 (not shown) that is located internal to the keypad 24. The infrared transmitter 92 communicates with the LEDs 80 and 82 and is configured to trigger the LEDs 80 and 82 to transmit an infrared signal in a well known manner. Any wide variety of conventional infrared transmitters known to those skilled in the art may be used with the present invention.

Figure 4 schematically illustrates the relationship between the infrared transmitter 92 and the keys 56 on the keypad 24. As discussed, a battery powers the remote keypad 24. The infrared transmitter 92 responds to input from the keypad 24 by transmitting an infrared signal through the LEDs 80 and 82 in response to a user depressing any of the keys 56 on the keypad 24. When a user depresses a particular key 56, the multifunction infrared transmitter 92 causes a transmission of a serial bit stream code signal through the LEDs 80 and 82. The serial bit stream code signal is unique to the particular key 56 on the keypad 24 that the user depressed. In a preferred embodiment, the infrared transmitter 92 communicates with a microprocessor 95 for encoding the serial bit stream code signal to the particular key that was depressed, in a well known manner. For instance, the serial bit stream code could be encoded "0000" if the "0" key is depressed or "1001" if the "9" key is depressed.

It is contemplated that the microprocessor 95 could also be used to store and process data if the remote keypad 24 is used as a personal digital assistant. The microprocessor 95 could be used in conjunction with a memory to store and process scheduling data, electronic mail, telephone numbers, and other data associated with personal digital assistants.

The infrared transmitter continues to transmit the serial bit stream code signal as long as the user keeps the key 56 depressed. The infrared transmitter halts transmission of the signal when the user releases the key 56.

Figure 5 schematically illustrates the internal circuitry components 93 of the handset 22. The internal circuitry components 93 are collectively configured to receive and decode the serial bit stream code signal transmitted by the keypad 24. As discussed, the internal circuitry of the handset 22 includes a multifunction infrared receiver 68 for receiving the bit stream code signal from the keypad 24. Preferably, the infrared receiver 68 communicates with a switch 101. When the switch 101 is open, the remote keypad 24 preferably communicates with the handset

22 through the infrared interface. When the remote keypad 24 is mounted on the handset 22, the switch 101 is closed and the handset 22 and keypad 24 communicate directly, such as through the contacting metal strips 46 and 50. In an alterative embodiment, the remote keypad 24 and handset 22 could also communicate via male and female electrical connections 103 (Figures 1 and 2). However, as the male connections 103 may make the remote keypad 24 more bulky, they are optional and communication via the metal strips 46, 50 is preferred.

An MPU 94 is also located within the handset 22. The MPU 94 communicates with the infrared receiver 68 and with a conventional telephone chip 96 that includes an MPU interface 100, as is known in the art. The preferred embodiment uses a Motorola MC34010 telephone chip, although any standard telephone chip known to those skilled in the art may be used. The telephone chip 96 also includes a DTMF transmitter 102, a tone ringer 104, a speech network 106, and a line voltage regulator 108. The circuitry of the handset 22 is standard and well known to those skilled in the art.

Preferably, when the handset 22 receives a bit stream code signal from the keypad 24, the DTMF transmitter 102 outputs a corresponding DTMF tone signal to the earpiece 26. Hence, the handset 22 provides tone feedback to the user's ear as the user depresses any of the keys 56 on the keypad, even when the keypad 24 is detached from the handset 22. This feature advantageously enables the user to determine, through the tone feedback, whether the desired key 56 was actually depressed. This is very convenient when using integrated voice response systems, where depression of a key triggers actions by the system.

Figure 6 illustrates a second embodiment of the present invention, referred to as telephone 20a. For ease of understanding, like numerals will be used between like parts of the two embodiments. The telephone 20a includes a fixed keypad 112 that is located on the abutment surface 40 on the handset 22. The fixed keypad 112 includes a plurality of keys 114. The keys 114 may be arranged identical to the arrangement of the keys 56 on the remote keypad 24. Alternatively, the keys 114 may be arranged differently. The keys 114 on the fixed keypad may be depressed by a user to dial the telephone 20a without using the remote keypad 24. Hence, the fixed keypad 112 allows a user to dial the telephone 20a even when the remote keypad 24 is misplaced or is separated from the handset 22.

In the embodiment illustrated in Figure 6, the remote keypad 24 includes at least one function key 116 located on the keypad surface 50 of the remote keypad 24. The function key 116 preferably causes the telephone 20a to perform a specific function when depressed by the user, such as to dial a specific telephone number. For example, the function key 116 may be red and act as a "panic" key that prompts the handset 22 to automatically dial the local police station.

As shown in Figure 6, a set of electrically conducting metal strips 46a are located on the abutment surface 40 for transferring power or information to and from the remote keypad 24 when it is coupled to the handset 22. The metal strips 46a are shown interposed between the keys 114. A corresponding set of electrically conducting metal strips 60 are located on the contact surface 52 of the remote keypad 24, as described above with respect to the first embodiment present invention. The keys 114 may be arranged in any variety of configurations on the abutment surface 40.

Figure 6 also illustrates an alternative mechanism for attaching the remote keypad 24 to the handset 22. A pair of tongues 120a and 120b (not shown) extends from the opposed sidewalls 54d and 54b (not shown), respectively. Locking lips 121 are located on the ends of each of the tongues 120a and 120b (not shown). A corresponding pair of slots 122a and 122b extend into the abutment surface 40 on the handset 22. The tongues 120 are configured to align with the slots 122 when the remote keypad is located within the recess 36. Preferably, a user may squeeze the tongues 120 toward each other to insert the tongues 120 into the slots 122. The user may then release the tongues 120 so that the locking lips 121 on the tongues 120 mate with the slots 122 in a press-fit fashion to secure the remote keypad 24 to the handset 22. Any other wide variety of coupling mechanisms may be used to couple the remote keypad 24 to the handset 22.

Operation of the Telephone

The manner of using the telephone 20 via handset 22 and remote keypad 24 remains essentially the same as the operation of a conventional telephone. However, due to the nature of the remote keypad 24, the user is able to enter DTMF or other information into the telephone 20 without having to first remove the telephone handset 22 from his or her ear. This is preferably accomplished through wireless communication between the handset 22 and the remote keypad 24 when the keypad is detached from the handset 22. As discussed above, the preferred embodiment of the telephone 20 uses an infrared signal interface between the handset 22 and the remote keypad 24. However, those skilled in the art will appreciate that any form of wireless communication could be used as such as, for example, UHF, VHF, radio, optoelectric, or microwave signals. A retractable wire could also be used to connect the handset 22 and remote keypad 24. In this manner, the handset 22 and remote keypad 24 could communicate through a direct electrical connection. The retractable wire could be mounted in the keypad 24 or the handset 22.

It will be appreciated that the communication path between the handset 22 and remote keypad 24 could be configured to pass information both from the keypad 24 to the handset 22 and from the handset 22 to the keypad 24. Hence, a transmitter could also be located on the handset 22 and a receiver could also be located on the remote keypad 24. This would enable the handset 22 to transmit a signal to the keypad 24. In this manner, the handset 22 could be configured to receive information through a telecommunication path and pass the information to the remote keypad 24.

Figure 7 is a flow chart that illustrates the preferred operation during use of the telephone 20. In the start state 200, the telephone 20 is in an "on-hook" state, meaning that a telecommunication line is not being accessed by the telephone 20. Although not required, the keypad 24 is preferably attached to the handset 22 at the start state 200. The telephone 20 receives a supply of electrical power from a standard electrical outlet or through a battery. Preferably, a rechargeable battery is mounted in the handset 22. The battery could be recharged by placing it in a cradle, as is well known in the art.

In state 202, the user places the telephone 20 in an "off-hook" state such that the telephone accesses a telecommunications line in a well known manner. When the telephone is placed in an off-hook state, power for the

multifunction infrared receiver 68 is activated (state 204), preferably through an electrical switch internal to the handset 22 which is responsive to the off-hook condition.

Referring to state 205, the remote keypad 24 may be either attached to or detached from the handset 22. When attached or coupled to the handset 22, the remote keypad 24 sources its power through the telephone handset 22, as shown in state 206 in Figure 7. The handset 22 supplies electrical power to the remote keypad 24 via the contacting metal strips 46 and 60 on the handset 22 and the remote keypad 24, respectively. As discussed above, the metal strips 46 on the handset 22 contact the metal strips 60 on the remote keypad 24 when the handset 22 and remote keypad 24 are coupled. Electrical power is transferred from the handset 22 to the remote keypad 24 through the metal strips 46, 60 in a manner well known to those skilled in the art. It is contemplated that the metal strips 46, 50 could also be used to transfer information signals between the handset 22 and keypad 24 in a well known manner when the keypad 24 is mounted to the handset 22.

Referring to state 208, when detached from the handset 22, the keypad 24 receives electrical power from an internal battery. The handset 22 continuously charges the battery in a well known manner whenever the remote keypad 24 is coupled to the handset 22. In a preferred embodiment, the battery power state is continuously monitored as to remaining battery charge, as shown in state 209. When the battery charge falls below a predetermined level, the low battery indicator light 58 illuminates to alert the user of low battery charge, as shown in state 212. The low battery indicator light remains in an off state if battery power is above the predetermined level, as shown in state 210.

In state 214, the user depresses any of the keys 56 on the keypad 24, such as when dialing a telephone number. When the keypad 24 is detached from the handset 22, the user is not required to remove the handset from his or her ear in order to depress the keys 56. The user may hold the keypad 24 in his or her hand or place the keypad 24 on a surface when depressing the keys so that the keys 56 remain fully visible. In any event, the earpiece 26 preferably remains adjacent the user's ear when keys 56 are depressed so that the handset 22 provides tone feedback to the ear. Additionally, the user continues to hear information conveyed over the telephone line when depressing the keys 56, which is especially advantageous when using integrated voice response systems.

Referring to state 216 in Figure 7, the keypad 24 transmits a unique serial code signal via the infrared transmitter 92 and LEDs 80 and 82 when the user depresses any of the keys 56 on the remote keypad 24. As discussed above, the LEDs 80 and 82 (Figure 3) are facing in different directions for increased angle of use when the remote keypad 24 is not coupled with handset 22. As shown in state 246 in Figure 7, the transmitter 92 repeatedly transmits the serial code signal as long as the key 56 is depressed.

Referring to state 248, the handset 22 receives and decodes the serial code signal through the infrared sensors 70, 72 (Figure 1) and the infrared receiver 68, as discussed above. A direct line of sight between the keypad LEDs 80, 82 and the infrared sensors 70, 72 improves the reception of the serial code signal by the handset 22. Because both infrared sensors 70 and 72 may receive transmissions from infrared LEDs 80 and 82 when the remote keypad 24 is not coupled to the handset 22, the reception of the handset 22 is improved. For example,

reception is not reduced even if the user positions the handset adjacent his ear such that the user's face covers the first infrared sensor 70, as the second infrared sensor 72 also receives the serial code signal.

As shown in state 250 of Figure 7, the handset 22 sends a corresponding DTMF signal over an attached telecommunications line, such as a telephone line, in response to the receiving the serial bit code signal from the keypad 24. The transmittal of the DTMF signal over a telecommunications line is a process well known to those skilled in the art and therefore no further description of this process is necessary.

From the above description, a number of advantages of the telephone 20 with the detachable remote keypad 24 become evident. The telephone handset 22 can be coupled with the remote keypad 24 easily and securely using the preferred mounting structures described herein. However, any other wide variety of structures may be used to couple the handset 22 and keypad 24. Preferably, the fully coupled telephone handset 22 and keypad 24 advantageously assumes a standard appearance with clean lines and a concealed low battery indicator light 58.

The keypad 24 may be used at any time without having to remove the handset 22 from the ear. This feature allows a user to interact with integrated voice response systems in a natural way without the loss of voice information while depressing keys 56 on the keypad 24. Furthermore, the handset 22 provides tone feedback to the user's ear as the keys are depressed, even when the keypad 24 is detached from the handset 22. The telephone 20 thus provides a new level of comfort and functionality for the user.

As discussed, the configuration of the keys 56 on the keypad may be modified to suit various uses. A single handset 22 may be configured to fit multiple keypads 24, each customized for a particular user or function. Many existing and future operational functions may be incorporated into the remote keypad 24, thereby allowing for a new level of flexibility in form and function.

Although the foregoing description of the preferred embodiment of the preferred invention has shown, described, and pointed out the fundamental novel features of the invention, it will be understood that various omissions, substitutions, and changes in the form of the detail of the apparatus as illustrated as well as the uses thereof, may be made by those skilled in the art without departing from the spirit of the present invention. Consequently, the scope of the present invention should not be limited by the foregoing discussion, but should be defined by the appended claims.

WHAT IS CLAIMED IS:

1. A telephone handset having a keypad module located between a mouthpiece and a telephone receiver, said keypad module being selectively removable from the handset, and a communication path between the keypad module and the handset permitting signals to be controlled by the keypad module when the keypad module is separated from the handset.

2. The telephone handset of Claim 1, wherein the communication path comprises a transmitter on said keypad, said transmitter configured to transmit a signal in response to a user depressing a key on the keypad module, and a signal receiver on said handset, said signal receiver configured to receive said signal.

3. The telephone handset of Claim 2, wherein said transmitter is an infrared transmitter and wherein said signal receiver is an infrared signal receiver.

4. The telephone handset of Claim 3, additionally including a light emitting diode on said keypad communicating with said infrared transmitter for transmitting an infrared signal, and an infrared sensor on said handset for detecting said infrared signal.

5. The telephone handset of Claim 1, wherein said communication path comprises a wire connecting said handset to said keypad module.

6. The telephone handset of Claim 1, wherein said telephone receiver outputs an audio signal in response to a user depressing a key on said keypad module.

7. The telephone handset of Claim 1, wherein said keypad module includes an internal battery for powering said keypad when said handset is detached from said handset.

8. The telephone handset of Claim 7, additionally including an indicator light on said keypad module, said indicator light configured to illuminate when a charge in said battery reduces below a predetermined level.

9. The telephone handset of Claim 1, additionally comprising a second keypad fixedly attached to said handset.

10. The telephone handset of Claim 1, additionally comprising a first connector on said handset and a second connector on said keypad module, said first connector configured to mate with said second connector to secure said keypad module to said handset.

11. The telephone handset of Claim 10, wherein said first connector is a pin and wherein said second connector is a keyhole sized to receive said pin.

12. The telephone handset of Claim 1, wherein said signal is a dual tone multifrequency signal.

13. The telephone handset of Claim 1, wherein said keypad module is a personal digital assistant, said keypad module including a microprocessor configured to store and process information.

14. The telephone handset of Claim 1, wherein said keypad module is a pager.

15. A telephone handset comprising a mouthpiece, a receiver and a plurality of keypad modules each having at least one key, each keypad module being selectively attachable to said handset.

16. The telephone handset of Claim 15, wherein said keypad modules attach to said handset between said mouthpiece and said receiver.

17. The telephone handset of Claim 15, additionally comprising a communication line between said handset and each of said keypad modules, said communication line permitting the passage of signals between said keypad modules and said handset when the keypad modules are separated from said handset.

18. The telephone handset of Claim 17, wherein said communication line is a wireless interface between said handset and each of said plurality of keypad modules.

19. The telephone handset of Claim 17, wherein said communication line is an electrical wire connecting said keypad module to said handset.

20. The telephone handset of Claim 17, wherein at least one of said keypad modules in said plurality of keypad modules includes a key that may be depressed by a user to transmit a predetermined combination of DTMF signals over said communication line.

21. The telephone handset of Claim 15, wherein an access code must be entered into at least one keypad modules in said plurality of keypad modules in order to operate said at least one keypad module.

22. A telephone handset comprising a receiver, a mouthpiece, a selectively detachable keypad module located on said handset, and means for transmitting a signal between said keypad module and said handset.

23. The telephone handset of Claim 22, wherein said signal is a dual tone multifrequency signal that is controlled by said keypad module.

24. The telephone handset of Claim 23, wherein said means for transmitting a signal between said keypad module and said handset comprises a transmitter on one of the keypad module or the handset, said transmitter configured to transmit a signal, and a signal receiver on the other of the handset or the keypad module, said receiver configured to receive said signal.

25. The telephone handset of Claim 24, wherein said transmitter is an infrared transmitter and wherein said receiver is an infrared receiver.

26. The telephone handset of Claim 23, wherein said means for transmitting a signal between said keypad module and said handset comprises a wire connecting said handset to said keypad module.

27. The telephone handset of Claim 23, additionally comprising a fixed keypad attached to said handset and wherein said fixed keypad is located underneath said keypad module when said keypad module is attached to said handset.

28. The telephone handset of Claim 23, additionally comprising a liquid crystal display on said handset.

29. The telephone handset of Claim 22, wherein said keypad module is located between said receiver and said mouthpiece when said keypad module is attached to said handset.

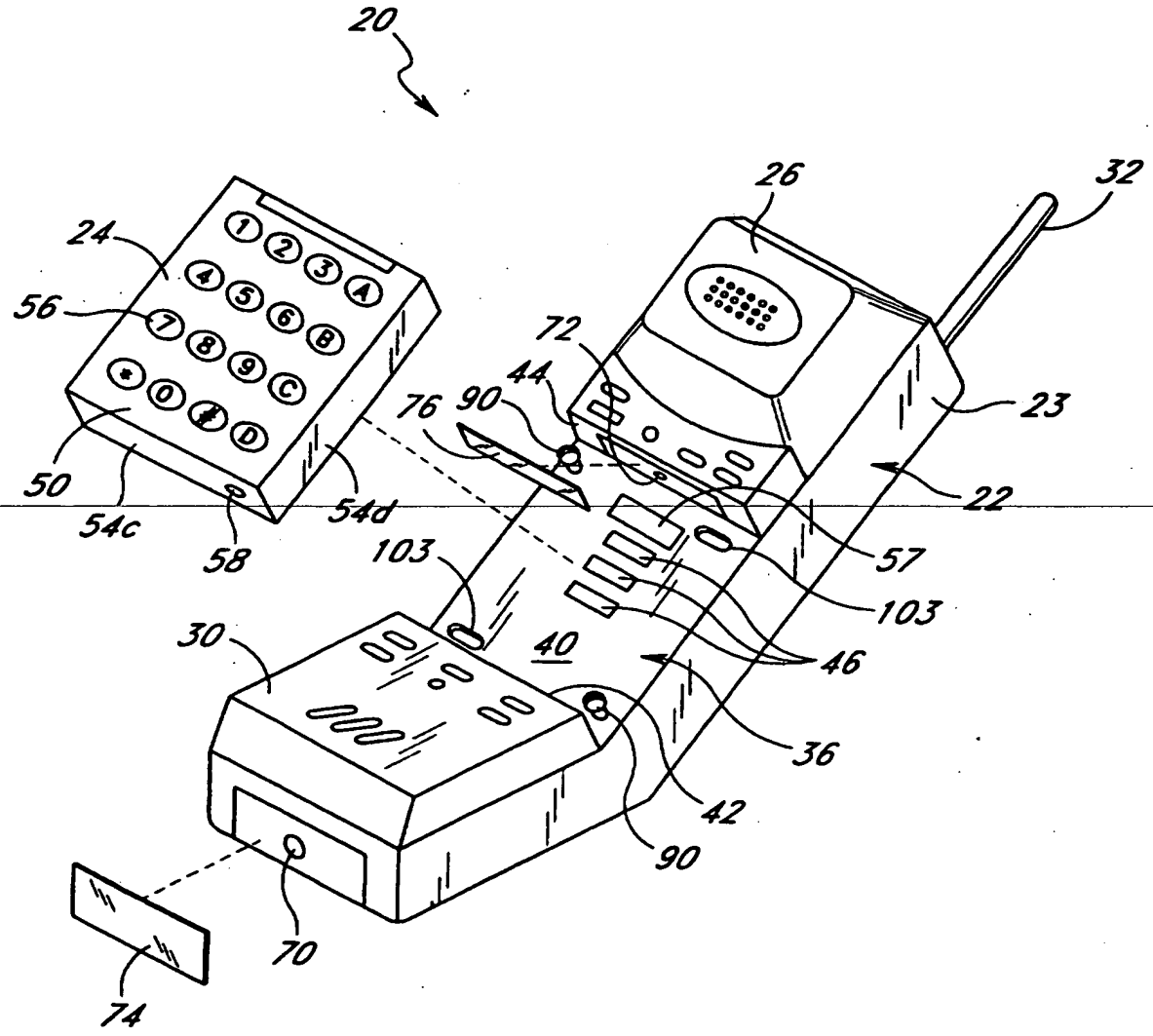
30. A method of operating a telephone, comprising:

providing a telephone of the type having a handset having a selectively detachable keypad module and a communication path between said handset and said keypad module;

detaching the keypad module from the handset; and

depressing keys on the keypad module to dial a telephone number.

31. The method of Claim 30, additionally comprising the step of entering an access code into the keypad module to enable operation of said keypad module.


20
24
56
50
54c
58
54d
26
32
72
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76
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103
103
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46
36
42
90
70
74

FIG. 1

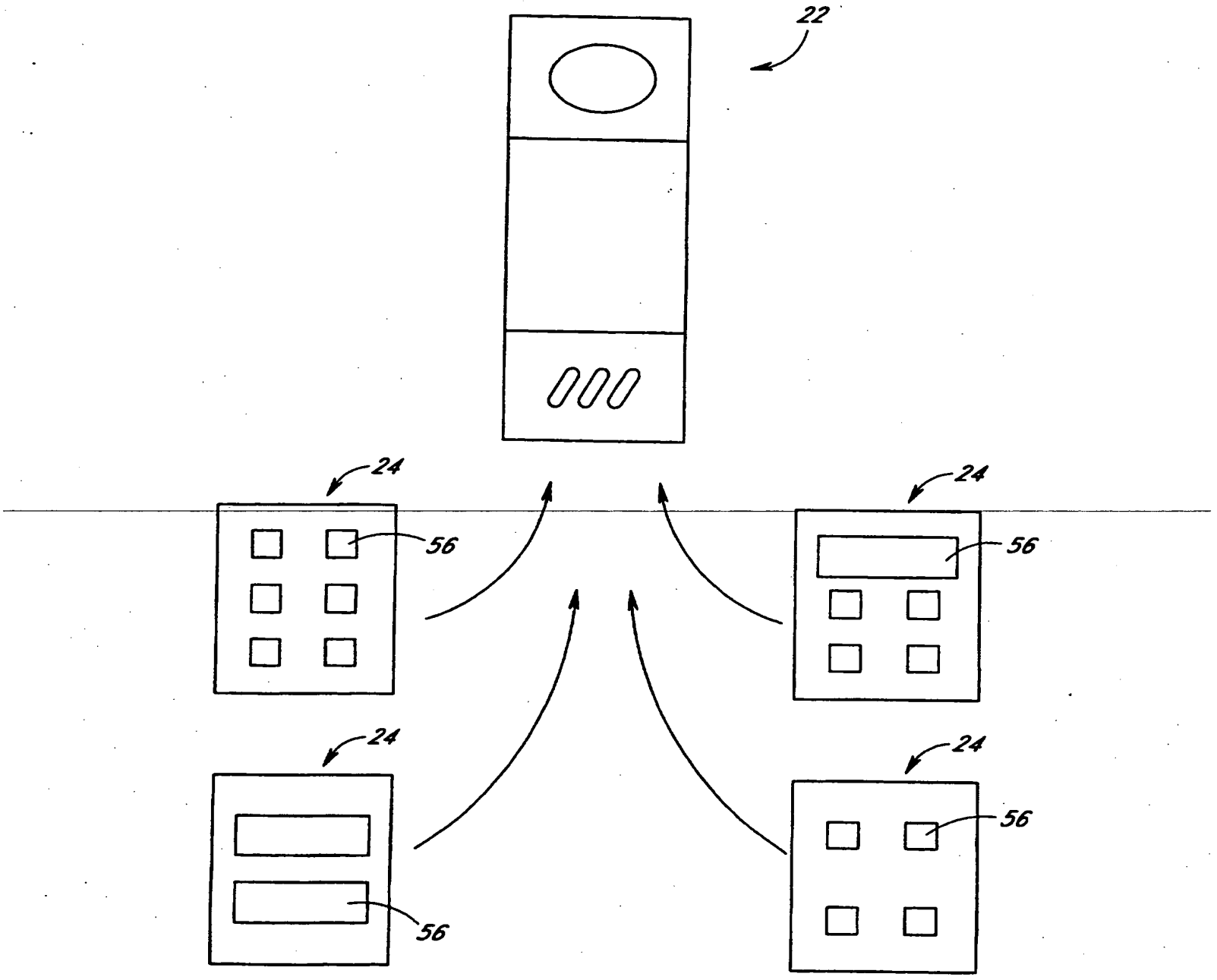


FIG. 2

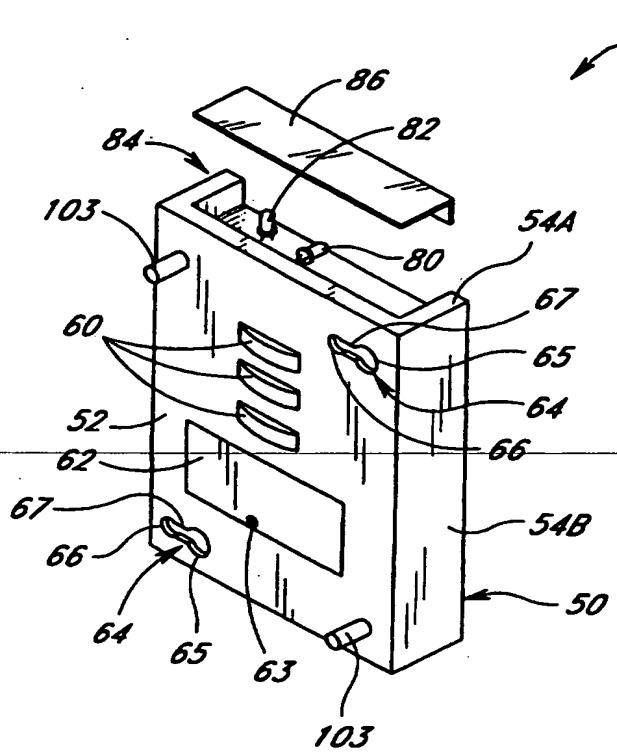


FIG. 3

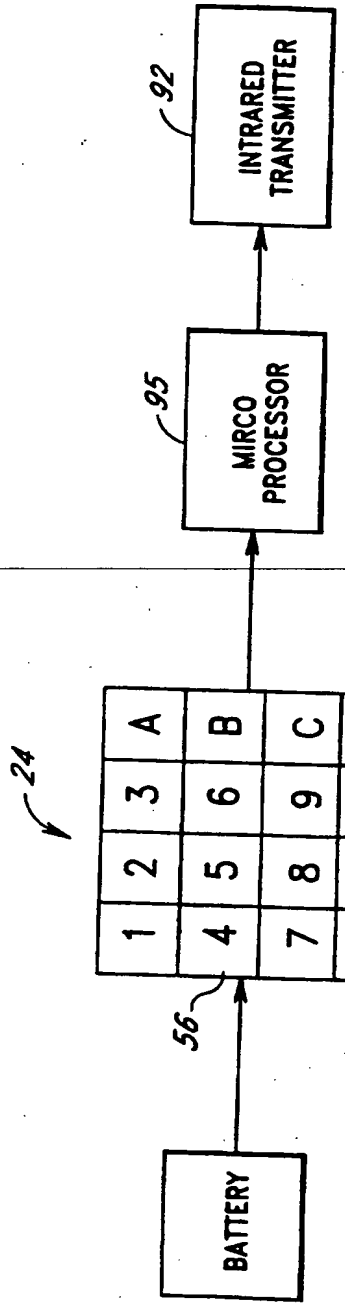


FIG. 4

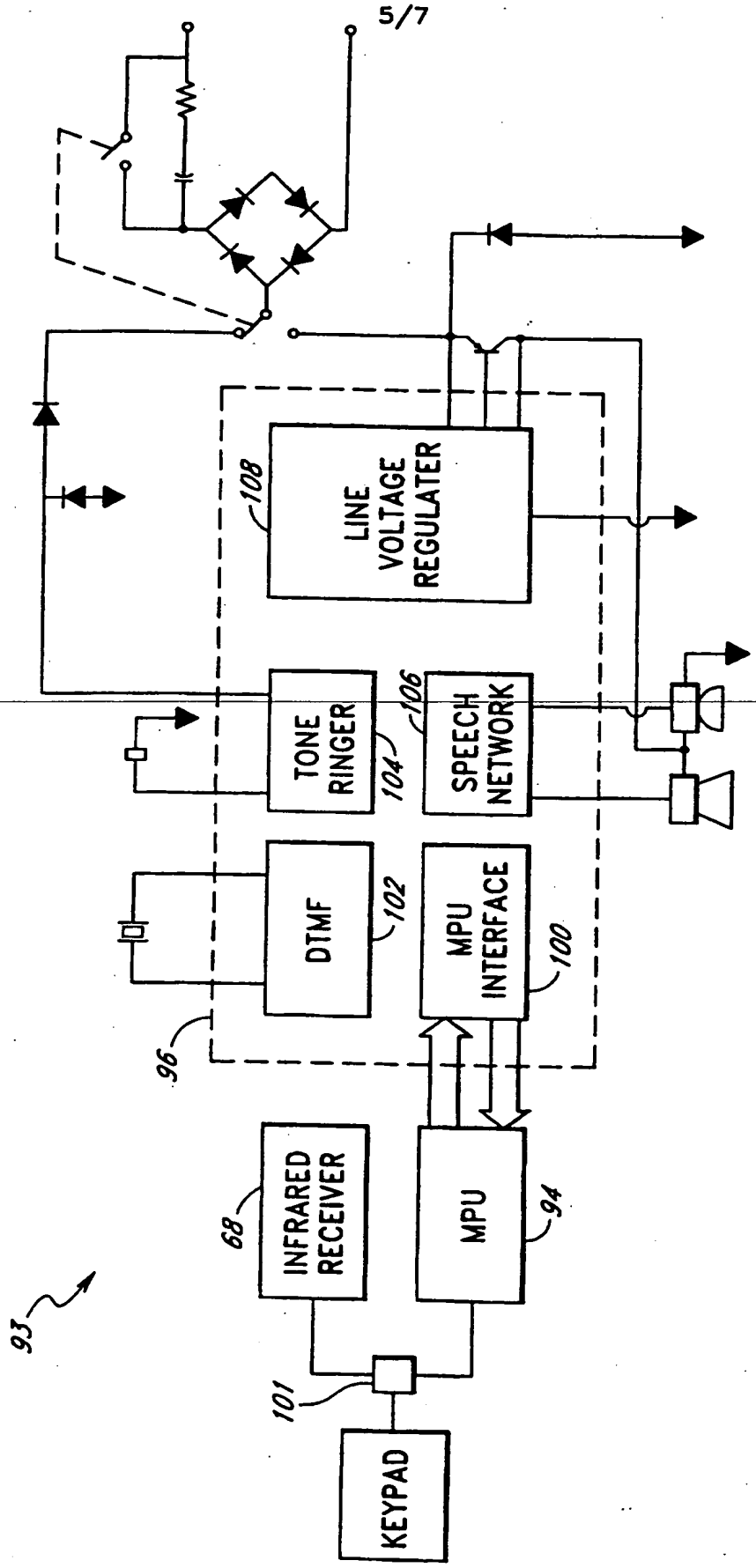
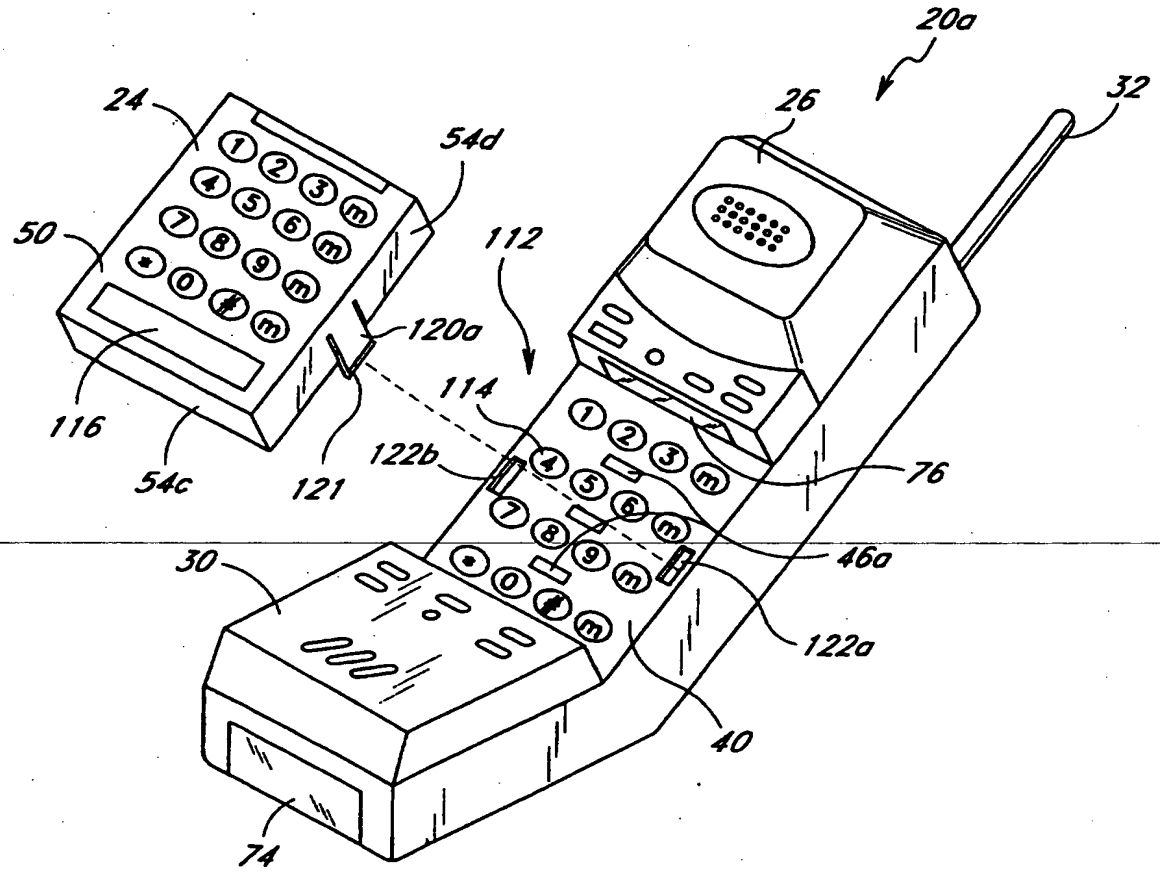

LINE VOLTAGE REGULATER
108
TONE RINGER
104
SPEECH NETWORK
106
DTMF
102
MPU INTERFACE
100
96
INFRARED RECEIVER
68
MPU
94
93
101
KEYPAD

FIG. 5


20a
24
26
32
54d
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112
120a
114
116
122b
76
54c
121
46a
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40
74

FIG. 6

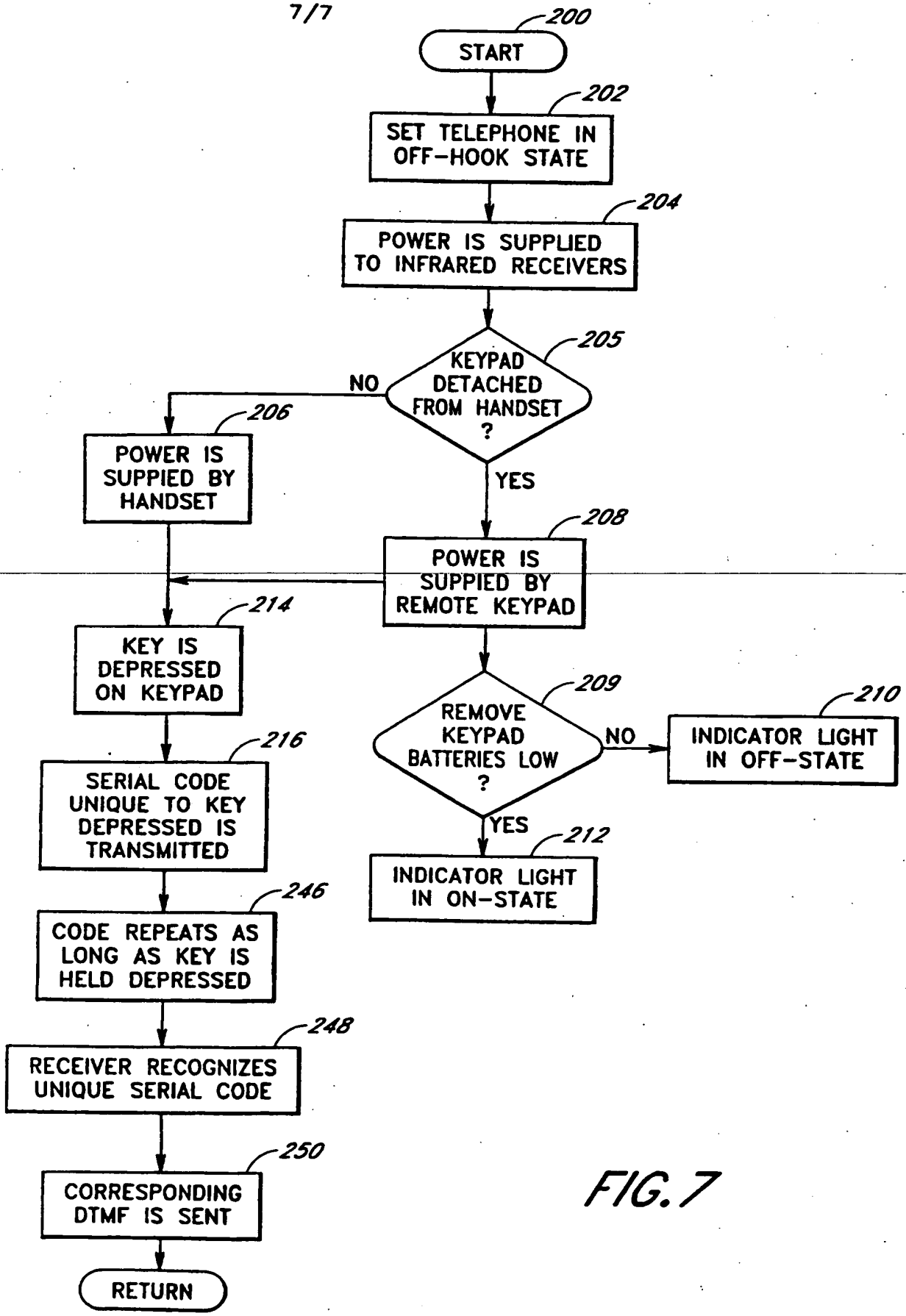

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/07765

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04M 1/00
US CL :379/433, 428, 434, 368-370
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/433, 428, 434, 368-370; 455/89-90

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,365,570 A (BOUBELIK) 15 November 1994, Figs. 1-4,col. 2, lines 35-68, col. 3, lines 1-63.	1-2, 5-10, 12-17, 19-24, 26-31
X	US 5,335,273 A (TAKAGI et al) 02 August 1994, Figs. 18-19, col. 6, lines 31-49.	1-10, 12-30
A	US 4,232,203 A (LENAERTS) 04 November 1980, Fig. 1, col. 1, lines 56-68, col. 2, lines 1-23.	11
A	US 4,192,976 A (SCOTT) 11 March 1980, Figs. 1-3, col. 2, lines 41-68, col. 4, lines 1-68.	11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 JULY 1997	20 AUG 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ZAL AZMI Telephone No. (703) 308-0000

Form PCT/ISA/210 (second sheet)(July 1992)*